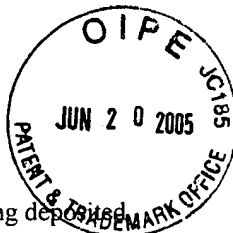


Appl. No. 10/718,003  
Declaration under 37 CFR 1.131



Docket No.: 135016-1

I hereby certify that this correspondence is being deposited  
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Assistant Commissioner for Patents  
P.O. Box 1450

Arlington, VA 22313-1450 on June 16, 2005 (Date).

Typed or printed name: Rita M. Lynne

Signature: Rita M. Lynne

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Appl. No. : 10/718,003  
Applicant : R.S. Bunker et al.  
Filed : November 19, 2003  
Title : Hot Gas Path Component with Mesh and Impingement Cooling  
TC/A.U. : 3745  
Examiner : KERSHTEYN, IGOR  
Docket No. : 135016-1  
Customer No. : 6147

Commissioner for Patents  
PO Box 1450  
Alexandria, VA 22313-1450

**DECLARATION UNDER 37 CFR 1.131**

Assistant Commissioner for Patents  
Alexandria, VA 22313-1450

S I R:

We, Ronald Scott Bunker, Ching-Pang Lee and Jeremy Clyde Bailey, declare and state:

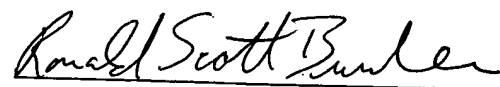
1. We are the coinventors of all of the claims of the patent application identified above and coinventors of the subject matter described and claimed therein.

2. Our invention was conceived prior to the June 9, 2003 filing date of U.S. Patent No. 6,808,367 (Liang). Specifically, prior to April 23, 2003, we had conceived our invention as described and claimed in the subject patent application in the United States, as evidenced by the following. Exhibit A is a partially redacted copy of the first four letters of a Patent Disclosure Letter that describes the subject matter of the present patent application. Exhibit A was submitted through the disclosure system at GE Global Research on Wednesday April 23, 2003,

as evidenced on page one of the Patent Disclosure Letter.

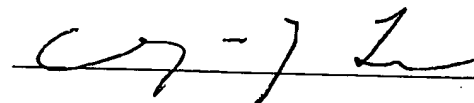
3. We reduced our invention to practice prior to the June 9, 2003 filing date of Liang, as documented on page 2 of Exhibit A, which states that reduction to practice data was obtained on April 15, 2003.

The undersigned declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.



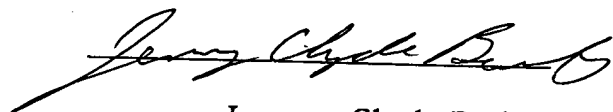
Ronald Scott Bunker

Date: 14 June 2005



Ching-Pang Lee

Date: 6-13-05



Jeremy Clyde Bailey

Date: 6-14-05

Exhibit A



\*\*\*\*\*

GE Confidential & Proprietary Information.  
This invention is being prepared for submission  
to the GE Patent And Legal Operation. Attorney  
work product may be contained herein.

\*\*\*\*\*

# **GE Patent Disclosure Letter System**

## **DOCKET NUMBER**

31850

## **DOCKET DATE**

Wednesday, April 23, 2003

## **TITLE OF INVENTION**

Airfoil Turbulated Mesh Cooling

## **GE TECHNOLOGY AREA(S)**

- GE Aircraft Engines (AEXX)

## **Keywords:**

- Turbine Airfoils
- GE Power Systems (PGXX)

## **Keywords:**

- Advanced Technologies 25 EA
- Gas Turbine Engineering 51 DV

## **PROJECT NAME**

I3 HPT Blade Cooling Technology

## **PROJECT NUMBER**

215401

## **PROJECT LEADER**

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Commissioner for Patents, Alexandria, VA 22313  
Date of Deposit: June 16, 2005  
Type or Print Name: KITA M. LYNCH  
Signature: Kita M. Lynch

Bunker, Ronald, S

**BUSINESS OR ORG. CONTACT INFORMATION**

**NAME** Cherry, David

**PHONE NUMBER**

**Was this invention first conceived or reduced to practice in the performance of work under a contract between GE and another non-government third party? NO**

**Date Invention Conceived :**

**Circumstances Invention Conceived i.e., described in patent notebook (include page #), technical report, letter, discussed in meeting minutes, etc.**

First described in meeting charts within GE showing proposed cooling geometries for testing. Meeting was a dry run for a in which the idea was shown.

No reduction to practice was done at that time. Reduction to practice data obtained April 15, 2003.

**Was this invention first conceived or reduced to practice in the performance of work under a US Government contract? YES**

**GOVERNMENT AGENCY** DOD

**GOVERNMENT CONTRACT** PRDA VII F33615-02-  
**NUMBER** C-2212

**ABSTRACT OF THE INVENTION**

**Please write a brief explanation of the invention (Limit to 350 words)**

In-wall turbine airfoil cooling by means of a mesh formed by low height-to-diameter ratio pins or pedestals separated by flow channels, the pins also being connected with or interspersed with rib-roughening or turbulator elements for further heat transfer augmentation. This invention provides a simple yet effective means for cooling performance advancement using relatively low Reynolds number cooling flows inside wall cooling meshes.

**BACKGROUND OF THE INVENTION**

**Please describe the problem or requirement addressed by your invention.**

The overall problem being addressed is that of improvement in cooling effectiveness within high-pressure, high-temperature turbine airfoils. It is desired to increase turbine

firing temperatures and/or to increase operational times at hot gas temperature conditions, while also reducing the cooling air used in the airfoils (blades). This requires improved cooling technology.

**How has this problem or requirement been addressed before?**

Past art and/or current technology in practice uses many forms of cooling technology, all based upon convective cooling with or without surface treatments such as turbulators. Specifically related to this invention, past art includes US Patent 6,402,470 "Method and apparatus for cooling a wall within a gas turbine engine", in which an airfoil wall section contains an internal array of very specially defined shaped pins leading to a film cooling exit region. This prior art does not allow for the further improvement of heat transfer effectiveness by any coincident means, and in fact is so defined as to physically deny such further means. This prior art is too complex by far. A simpler and more direct technology is required.

**Is this disclosure letter related to any GE disclosure letters, patent applications or issued patents?**

YES

RD-30416 US 5690472

**Have you completed a prior art search? YES**

**Please list any relevant literature or patents of which you are aware.**

**DETAILED DESCRIPTION OF THE INVENTION**

**How does your invention work?**

In this invention, the mesh is formed by low height-to-diameter (H/D) pins or pedestals on the order of H/D equal to 0.1 to 0.3. In such a case, this is no longer a traditional pin-bank, but instead a flow network mesh where the overall blockage is 40% or even greater. Into this mesh network are placed turbulators to promote the further disruption of flows and thus enhance heat transfer effectiveness. This combination allows the use of low pressure loss circular pins (as an example) with fairly high blockage turbulators to result in an acceptable total pressure loss at high thermal performance. The turbulators may be placed in one of several orientations, either connecting the pins along a surface, or between pins, or both, and several orientations, either transverse to the main flow direction or at an angle, or angles. The turbulators provide substantial flow disruption without significant material or weight addition. This allows the mesh to

have a higher pin-to-pin spacing, which greatly reduces the weight of the blade. Pins do not need to be circular only, they can take on other low-loss shapes. Circular provides the simplest and easiest to manufacture.

**Describe the important features of your invention and explain how to use the invention to solve the problems described above.**

1. Enhanced heat transfer coefficients by factors of 2 to 2.3. 2. Mixed effects of pressure loss to obtain an acceptable flow solution. 3. Reduced blade weight by allowing fewer pins. 4. Capability to be investment cast. 5. Ability to tailor local factors by variation of geometries. 6. Enhanced in-wall cooling leading to higher turbine performance.

**What advantages are provided by your invention?**

1. Cooling enhancement. 2. Casting simplicity. 3. Weight reduction. 4. Distributed and controlled cooling flows. 5. Lower cost to manufacture.

**Has your invention been reduced to practice? YES**

Date: April 15, 2003

**Briefly describe any efforts to make a prototype of your invention or to test your invention. Additionally, summarize the results of any related experiments and testing and highlight any results of particular significance.**

Reduction to practice is in the form of a laboratory test measuring the pressure loss and heat transfer coefficients and comparing these to other technologies. See enclosed data.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**Please describe the significance of any pictures, drawings, graphs, diagrams, structures or figures and the type of picture along with the specific view or application to the invention.**

Shown on charts enclosed.

**CLAIMED INVENTION**

**Please identify novel aspects that should be protected within this disclosure letter.**

1. Enhanced heat transfer coefficients by factors of 2 to 2.3. 2. Mixed effects of pressure loss to obtain an acceptable flow solution. 3. Reduced blade weight by allowing fewer pins. 4. Capability to be investment cast. 5. Ability to tailor local factors by variation of geometries. 6. Enhanced in-wall cooling leading to higher turbine performance.